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Filed : July 9, 2003

REMARKS

Claim 1 has been amended. Support for a "nitrogen-doped" silicon carbide film can be found throughout the specification, e.g., page 4, line 7. Support for a "non-alicyclic alkyl silicon compound" can be found, for example, at page 4, lines 18-21 (all listed compounds are non-alicyclic). Support for a ratio of "more than 0 but no more than about 0.15" can be found, for example, at page 12, Conditions A, B, and C in Table 4 where the ratios are about 0.11, 0.15, and 0.15, respectively. Support for the remaining recitations can be found in the original claims, for example.

Claim 2 has been amended consistently with the amendment to Claim 1. Claim 7 has been amended in view of the amendment to Claim 1. Claim 15 has been amended, and support therefore can be found, for example, at page 4, line 10. Claim 19 has been amended in view of the amendment to Claim 1.

The amendments do not constitute the addition of any new matter to the specification. Applicant respectfully requests entry of the amendments and reconsideration of the application in view of the amendments and the following remarks.

Rejection Under 35 U.S.C. § 102

Claims 1, 4-13, 15, and 17-22 are rejected under 35 U.S.C. § 102(e) as being anticipated by Xia et al (US 2002/0142578 A1). Applicant respectfully traverses the rejection.

First, the Examiner asserts: "Xia et al discloses providing a silicon source, carbon source (pg. 3, paragraph 0046) and nitrogen source (pg. 3, paragraph 0047) and an inert gas into a reaction zone." (Emphasis added.) However, Xia et al states: "Helium (He), argon (Ar), nitrogen (N₂), or combinations thereof, among others, may be used for the inert gas." (page 3, paragraph 0047) Thus, in Xia et al, N₂ is included in an inert gas, and is not used as a reactive nitrogen source gas. Although Applicant disagrees with the Examiner, in order to expedite the prosecution, Applicant has added "comprising ammonia" which is in no way taught in Xia et al. Further, the reaction step in Claim 1 has been amended for clarification to read "reacting the silicon and carbon source gas and the nitrogen source gas to deposit on the substrate a nitrogen-doped silicon carbide film." Xia et al does not teach or suggest a nitrogen-doped silicon carbide film.

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Second, the Examiner asserts: "Xia et al discloses producing an electric field in the reaction zone (pg. 2, paragraph 0031) the electric field generated using low and high frequency RF energy produced by an RF power supply (pg. 2, paragraph 0030)." (Emphasis added.) However, it appears that the Examiner misunderstand Xia et al. Page 2, paragraph 0030 states "the electric field is generated by coupling the wafer support pedestal 250 to a source of radio frequency (RF) power (not shown) through a matching network (not shown)." (Emphasis added.) Applicant believes that the Examiner thinks that "through a matching network" means using low and high frequency RF energy; otherwise Xia et al in no way discloses or suggest a mixture of low and high RF frequencies. However, a matching network is used to match impedance of RF power since the impedance in the reaction chamber is not constant. The matching network is absolutely unrelated to a mixture of low and high RF frequencies.

Thus, Xia et al does not teach every element in Claim 1 as amended herein, and could not anticipate Claim 1. The remaining claims depend from Claim 1, and at least for the reason, the remaining claims also could not be anticipated by Xia et al. Applicant respectfully requests withdrawal of this rejection.

Rejection of Claims 2 and 3 Under 35 U.S.C. § 103

Claims 2 and 3 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Xia et al. Claim 2 has been amended, and Claim 3 has been canceled. Claim 2 depends from Claim 1.

The Examiner asserts that although Xia et al does not disclose the specific ranges, it would have been obvious to provide such specific ranges because Xia et al discloses the general conditions. However, as discussed above, Xia et al does not teach or even suggest specifically mixing low and high frequency energies. Further, Xia et al does not teach or even suggest producing a nitrogen-doped silicon carbide film using a nitrogen source gas comprising ammonia. Specifically mixing low and high frequency energies is not simply discovering the "optimum range" of RF energy. Further, Xia et al clearly fails to teach nitrogen-doping.

As the accompanying declaration shows, when low-frequency RF energy is mixed at a ratio of more than zero but no more than about 0.15, the resulting SiCN films exhibit excellent compressive stress, leakage current property, and dielectric value as a barrier layer. These excellent effects could not be seen in SiC films.

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Thus, clearly, Claim 1 and Claim 2 could not be obvious over Xia et al. Applicant respectfully requests withdrawal of this rejection.

Rejection of Claims 14 and 16 Under 35 U.S.C. § 103

Claims 14 and 16 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Xia et al (US 2002/0142578A1) in view of Xia et al (6,759,327B2). Claims 14 and 16 depend from Claim 1.

First, the Examiner asserts: "since Xia et al (US 2002/0142578A1) in view of Xia et al (6,759,327B2) are from the same field of endeavor, the purpose disclosed by Xia et al (6,759,327B2) would have been recognized in the pertinent art of Xia et al (US 2002/0142578A1)." However, Xia et al ('578A1) teaches specific SiC films and Xia et al ('327B2) teaches specific SiCN films. The Examiner fails to show that SiC and SiCN have compatible properties. As the accompanying declaration shows, SiC and SiCN exhibit different characteristics, especially reactivity to low frequency RF energy. Thus, this rejection could not be sustained.

Second, Xia et al ('327B2) uses specific SiHa(CH₃)_b(C₆H₅)_c compounds wherein c is 1 to 4. Xia et al ('327B2) must use alicyclic compounds. Further, Xia et al ('327B2) does not generally or specifically teach or suggest mixing low and high frequency energies. Thus, a combination of Xia et al ('578A1) and Xia et al ('327B2) could not lead to Claim 1 as amended herein.

Claim 1 and Claims 14 and 16 could not be obvious over Xia et al ('578A1) and Xia et al ('327B2), and Applicant respectfully requests withdrawal of this rejection.

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CONCLUSION

In light of the Applicant's amendments to the claims and the foregoing Remarks, it is respectfully submitted that the present application is in condition for allowance. Should the Examiner have any remaining concerns which might prevent the prompt allowance of the application, the Examiner is respectfully invited to contact the undersigned at the telephone number appearing below.

Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: 2/22/05

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